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Does Equity-Based Compensation Increase Managers' Ownership'

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Taking Stock:

Does Equity-Based Compensation Increase Managers' Ownership?

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Abstract

We find that executives sell shares of previously owned stock after receiving equity-based incentive compensation, counteracting boards' attempts to tie their wealth to firm value. Executives sell stock during years in which they receive new stock options or restricted stock, and some evidence indicates further selling over time if options move into-the-money. When options are exercised, managers sell a large majority of shares acquired. Effects are strongest for executives who already hold many shares, while stock-based compensation does appear to increase the holdings of managers with low ownership. Although valuation theorists who study executive compensation frequently assume that executives cannot hedge the risks of stock-based pay, our research provides evidence to the contrary.

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Taking Stock:

Does Equity-Based Compensation Increase Managers' Ownership?

Stock-based executive compensation awards, including options and restricted shares, have spread at explosive rates in the pay packages of U.S. executives during the 1990s. Bowen (1996) reports that in 1995, the 200 largest U.S. companies had reserved more than 10% of their common shares to be awarded to managers for executive compensation, up from about 6% just six years earlier. Institutional investors and shareholder activists have tolerated and even encouraged this diversion of equity to executives, believing that increased managerial ownership may reduce agency problems. Boards' compensation committees routinely cite the benefits of managerial ownership as the rationale for awarding large equity-based compensation.[1]

Although boards often intend for stock option and other awards to boost the ownership positions of managers, there is no assurance that executives will have the same goal. Modern portfolio theory predicts that managers receiving additional stock in their firms should sell these shares or equivalently, sell other shares they already own, to diversify away the unsystematic risk associated with concentrating wealth in a single asset. This risk is higher for managers than for

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[1] For representative examples from well-known firms, see the proxy statements filed by Minnesota Mining and Manufacturing Co. in 1997, which stated that "the company's stock option plan . . . is designed to increase ownership of the company's stock," and by Procter & Gamble Co. in 1995, in which the firm's description of its compensation policy referred to "the company's desire to increase management's stock ownership."

ordinary investors, since executives already have their human capital value correlated with firm performance.

We investigate how managerial ownership responds to awards of stock options and restricted stock. We study year-to-year changes in stock ownership in 1993, 1994, and 1995 for 8,516 top managers in 1,646 firms of all sizes, a total of 18,558 person-year observations. We find that executives sell stock during years in which they receive new stock options, partly counteracting their boards' attempts to tie managerial wealth more closely to firm value. When options are exercised, the typical manager sells a large majority of the shares acquired, perhaps partly to pay taxes and raise funds for the exercise price, but also apparently to reduce financial risk. We also find some evidence of year-to-year hedging behavior by managers, with additional sales of stock occurring as previously awarded options move into-the-money. The cumulative effects of this selling at the time of an option grant, while the option is held unexercised in inventory, and when it is exercised, appear to remove substantially all of the incentives that would have arisen from a stock option award.

For restricted stock, data limitations prevent us from undertaking the same detailed analysis as done for options. However, we are able to analyze stock ownership changes for years in which firms make restricted stock awards, and we find that marked degrees of selling take place, to a greater extent than our findings for stock option awards.

The patterns we observe are not materially different between small, mid-sized and large firms and for CEOs compared to other executives. One variable that does seem important is the level of a manager's stock ownership before he receives an award. We divide our executives into subsamples demarcated by the median percentage ownership of their firms' equity, and we find

far more pronounced selling activity among the high ownership group for all three events studied. More refined analysis along these lines suggests that the selling of shares at the time of stock option awards is concentrated among managers in the top ownership decile, while selling at the time of both stock option exercises and restricted stock awards occurs throughout the spectrum of ownership, with steadily increasing intensity as ownership rises. For low ownership executives, therefore, stock-based compensation does appear to have effectiveness for raising managerial incentives.

Our results should prove interesting to several audiences concerned with executive compensation, including shareholders, boards of directors, compensation consultants, and investment analysts. For financial theorists who model the value to executives of stock options and related compensation instruments, our findings cast doubt on the frequent and important assumption that managers are unable hedge the risks of these awards.

The paper proceeds as follows. Section I develops hypotheses. Section II describes our data. Section III presents analysis and discussion of the results. Section IV contains a discussion and conclusions.

I. Hypotheses

Most influential models of principal-agent conflicts, beginning with Jensen and Meckling (1976) and Holmström (1979), either tout the benefits of high managerial ownership or suggest "sharing rules" under which stockholders allocate in advance to the managers some fraction of the firm's returns. Stock options, restricted stock, and occasionally other types of stock-based compensation have been used by virtually all major U.S. companies for this purpose. However,

stock-based compensation has the effect of making managers' wealth undiversified. The underdiversification problem is compounded for senior executives since their human capital value already depends on the firm's performance, and since they may already have a large fraction of personal wealth invested in company stock before receiving more stock-based pay.

Our research studies this divergence of interests between a manager, who for risk-reduction reasons should not ordinarily want to hold a large amount of company stock, and a company's shareholders, whose representatives, the board of directors, periodically award stock compensation to the manager to heighten the wealth consequences of the manager's performance. Our hypothesis tests attempt to distinguish between two paradigms of how an executive might behave after receiving stock-based compensation. If the executive respects his firm's goal of tying his wealth more closely to firm value, he will not adjust his other holdings of stock in the company. Our null hypotheses, predicting zero change in stock holdings, are based on this type of behavior. Our alternative hypotheses are derived from the behavior of a manager who follows modern portfolio theory and tries to avoid concentrating wealth in one asset. This manager will be expected to sell the award itself if permitted, or equivalently, to sell other shares in the company that he already owns. Of course, exceptions to both of these paradigms will exist if the managers have inside knowledge about their firms' prospects, but we expect such knowledge to be evenly distributed between optimistic and pessimistic over our comprehensive sample of thousands of companies and not bias our results in any direction.

A. Stock Options

Hedging the risk imparted by a stock option award is complicated by the problem that the

option itself is illiquid, as managers ordinarily may not sell stock option awards to others and their options usually do not become exercisable for several years (most executive options have ten year lives, are granted at-the-money, and "vest" to become exercisable gradually over three or four years). However, a suitable hedging strategy would involve selling other shares of stock that the manager already owned. To hedge the risk perfectly, the manager would want to sell a number of shares equal to the number of options awarded, multiplied by the change in option value per unit change in stock price. This rate of change, called the "delta" or "hedge ratio" when used with the Black-Scholes (1973) valuation model, always falls between 0 and 1, implying that a manager seeking to hedge the risk of a stock option award will sell some shares of stock but fewer than the number of options awarded. Numerous investigators, beginning with Jensen and Murphy (1990), have estimated hedge ratios for typical executive stock options in the neighborhood of 0.6. However, most of these estimates ignore the complicated personal income tax questions associated with executive stock options; these tax problems and also transaction costs make prediction of real-world selling behavior problematic. We therefore test the null hypothesis that managers sell no shares during years in which they receive option awards; the alternative hypothesis is that managers sell some stock, but somewhat less than 100% of the number of shares placed under option.

After selling some shares at the time of the award, a manager may want to continue selling stock for risk-reduction reasons if the firm's value rises over time. As the stock price increases, options will move into-the-money and their rate of change in value per unit increase in firm value (the hedge ratio) will rise. The passage of time also increases the hedge ratio provided the stock price is above the exercise price, which should be the case for a large majority of the

options awarded during the bull-market period of our sample. Under these conditions, managers' wealth increases as does the need to continue hedging the unsystematic risk associated with the options. This effect may not be large empirically, however, since transaction costs and tax consequences might swamp the benefits associated with year-to-year hedging of relatively small changes in option values. We therefore test the null hypothesis that no relation exists between managers' inventories of previously awarded options and their sales of stock. The alternative hypothesis is that higher inventories imply increased selling, especially during years in which the firm's stock price rises.

The exercise of stock options triggers a further need for managers to sell shares in order to reduce risk, since the hedge ratio increases permanently to 1 at this point. Further, executives may need to sell shares in order raise funds to pay the exercise price or pay income taxes associated with the option exercise. We therefore test the null hypothesis that managers retain all shares acquired from exercising stock options and sell none; the alternative hypothesis is that a significant number of shares acquired from option exercises are sold soon after.

B. Restricted Stock

When a manager receives a restricted stock award, he obtains shares whose re-sale is barred for a period typically lasting three to five years. Conceptually, a restricted stock award is equivalent to an option with an exercise price of zero. Although little research has considered the value to managers of these awards, it is plain that their sensitivity to firm value is greater than that of stock options granted at-the-money and is likely close to 1. We therefore test the null hypothesis that managers sell no shares during years in which they receive restricted stock. A

further possible null hypothesis is that managers sell shares equal to 100% of the number of restricted shares awarded, since one would expect a manager who followed modern portfolio theory to attempt to liquidate his new position almost completely for diversification reasons. The alternative hypothesis between these two extremes is that managers sell a significant number of shares when they receive restricted stock, and that the number sold falls somewhere between 0% and 100% of the number awarded. For reasons noted above, we expect this effect to be larger than that observed for selling in response to stock option awards.

We do not have a hypothesis about hedging the value of restricted stock inventories over time because unlike stock options, restricted shares do not experience a change in the hedge ratio if the underlying stock price changes.

We might expect managers to sell shares of stock in years in which restricted shares become "vested" with their restrictions lapsing, certainly for tax reasons (the lapsing of restrictions usually triggers a tax obligation) but possibly also for risk reduction. Unfortunately, we do not have data for these events and cannot pursue this analysis.

C. Managers with Low Stock Ownership

A necessary condition for most of our alternative hypotheses to hold is that a manager already own stock in his firm before he receives options or restricted shares; otherwise, he could not have a way of selling shares to hedge the unsystematic risk posed by a new, illiquid compensation award. For executives newly hired from outside or young managers who have been rapidly promoted, stock ownership may be low or nonexistent. Boards may also pressure low ownership managers to acquire some minimum stake in the firm. We therefore predict that

the intensity of each selling effect is reduced for managers with low ownership, both because a manager cannot sell shares without already owning some, and also because the desire for diversification should be greatest among managers who already own large inventories of shares.

II. Data Description

Standard and Poor's Corp.'s ExecuComp database serves as our data source. ExecuComp includes annual data reported in proxy statements for the five highest paid executives in three different cohorts of firms: the S&P 500, the S&P MidCap 400, and the S&P SmallCap 600. S&P adds and drops a few firms from the sample each year, resulting in a universe of 1,646 companies providing useable data for our analysis.

The database includes four years of compensation data for the period 1992-95. We calculate changes in stock ownership by taking first differences and therefore lose one year of data. Allowing for year-to-year changes in sample composition and the identity of some firms' top executives, we have a total of 18,558 annual observations for 8,516 executives. Since our goal is to study whether managers respond to stock-based compensation awards by selling previously held shares, we narrow our sample to 13,148 observations by excluding those managers with zero stock ownership at the start of the year and also dropping those who do not either receive a stock option or restricted stock award or exercise previously awarded options during the year. Unfortunately, S&P reports few characteristics of each executive except for job title; such variables as age and years tenure with the firm which might be interesting for our research are missing for a very large majority of individuals.

S&P reports relevant compensation data for all of our executives, including the number of

stock options awarded during the year, number of stock options held at the end of the year, and value of restricted stock awarded during the year. We estimate the number of restricted shares by dividing this award value by the year-end stock price. Changes in direct stock ownership are calculated by subtracting the year-end number of shares owned from the prior year's total. A slight timing problem arises because companies report stock ownership (though not option ownership) as of the date of the proxy statement, usually in mid-March for a company whose fiscal year ends in December. Therefore, we calculate year-to-year differences in stock ownership based on dates that are approximately ten weeks after fiscal year-end. We do not expect this to create serious bias, since the frequency and magnitude of compensation awards across our sample does not vary greatly from year-to-year, and since it is quite plausible that executives wait several weeks before selling shares in response to executive compensation awards. We test the importance of this timing problem later in the paper by repeating our analysis on a cumulative basis over a three-year period for which the ten-week timing incongruence should be far less important; as shown later, our results exhibit virtually no change when calculated on a one-year or three-year basis, leading us to conclude that any bias from timing measurement is unimportant.

We use data adjusted for stock splits so that all ownership and award variables are stated in common 1996 units. ExecuComp provides financial statement data and stock performance information that we use.

Table 1 reports descriptive statistics for our sample. Panel A indicates that within our universe of more than 18,000 person-year observations, slightly more than two-thirds of executives receive stock option awards in a given year, and approximately one out of every three

exercises options in a given year. Restricted stock awards occur during slightly more than one-sixth of our executive-years. We narrow our sample to those managers who hold at least one share of stock and either receive new options or restricted shares or exercise previously held options during the fiscal year. Panel B presents data showing that among this group, which excludes those managers holding zero stock, most executives' ownership appears quite low. The mean stock holding is about 428,070 shares, or 0.83% of the company's outstanding equity, though the median values are far smaller at 41,700 shares, or 0.076%. Annual changes in stock ownership are close to zero: a mean of -12,550 shares and a median of +810. These small annual changes seem surprising, since a large majority of the executives in our panel receive stock-based compensation awards almost every year, typically involving tens of thousands of new shares for each person. Panel B also presents information about average option award sizes as well as option exercises and restricted stock awards. The lower half of the table shows this information on a cumulative three-year basis, for the 3,222 qualifying executives who appear in all three years of the study with the same firm. Finally, Panel C presents data comparing the stock ownership and stock-based compensation awards for CEOs and all other executives.

Before proceeding to the analysis, we note that our estimates of selling by executives for risk-reduction motives are likely to be under-inclusive. In recent years derivative securities dealers have developed many ways for managers to realize value from their equity holdings without having to "sell" their shares in a legal sense that would lead to reporting in our dataset. These methods include equity swaps (Bolster, Chance and Rich, 1996), put options, "collars" and related strategies (Ip, 1997), and secured borrowing using the stock as collateral (O'Brian, 1997). Ip (1997) states that an official of a firm that tracks insider selling and pseudo-selling "believes

the level of insider disclosure of such derivative transactions is far below the actual level of insider activity." While tax avoidance is a major motive for these *de facto* sales, and the evasion of disclosure requirements may also be important, market professionals cite risk reduction via diversification as an important goal of many executives. O'Brian (1997) quotes a vice president of Merrill Lynch as saying, "All their [executives'] wealth is tied up in one thing, generally their company's stock. We need to provide them with liquidity."

III. Analysis

A. Ownership Changes in Response to Compensation Awards

Our most straightforward tests for whether managers adjust stock ownership in response to compensation awards come from ordinary least squares (OLS) regressions of changes in shares owned against the number of shares obtained from various forms of compensation. Table 2 presents the main results of our study. A positive value for the dependent variable, the change in shares owned, indicates a rise in ownership, while a negative value indicates selling of shares to reduce ownership.

1. Stock option awards

In the first column of Table 2, Panel A, we present estimates for how executive stock ownership changes during years in which executives receive new stock options. We estimate this regression over the subsample of 11,321 person-years in which managers who already hold at least some stock receive new stock option awards (some of these managers will own fewer shares than the number of options awarded, and thus will be unable sell as many shares as

awarded). Since stock options do not count towards an executive's stock ownership in our dataset until the options are exercised and converted to stock, our null hypothesis is that zero change will occur in stock ownership during these years. The coefficient estimate of -0.180 implies that for every 1,000 new stock options awarded, a typical executive can be expected to sell 180 shares of stock, in line with our alternative hypothesis that executives respond to stock option awards by selling previously owned shares. However, our estimate falls short of the generally cited hedge ratio estimate of about 0.6, implying that managers do not entirely remove the wealth risks associated with new options, at least not during the award year.

We test the statistical significance of all our OLS estimates with both regular standard errors and White (1980) standard errors robust to serial correlation and heteroskedasticity. As shown underneath the coefficient estimate of -0.180 in the first column in Table 2, our finding that executives sell shares in response to stock option awards is statistically significant below the 1% level according to the regular standard error, and at the 10% level according to the White standard error. Formal tests reveal that our data exhibit mild heteroskedasticity with respect to the company's stock price, and more serious heteroskedasticity with respect to the number of shares held by each executive. To the extent that the White (1980) heteroskedasticity adjustment is correcting for the latter problem, we are not certain that the larger standard errors should receive great weight. Results presented later in the paper indicate that low and high ownership executives behave very differently after receiving stock-based compensation, and our analysis of regression output indicates that low ownership managers exhibit residuals far smaller in absolute value. For clear economic reasons low ownership managers are far less likely to sell large numbers of shares, mostly because they do not own many to begin with, and probably also

because of implicit pressure from their boards to accumulate at least modest ownership in the firm. We also believe that low ownership managers are less likely to be large open-market purchasers of shares, since they almost surely have less personal wealth than their high ownership counterparts. We therefore are reluctant to stress the importance of standard errors that are adjusted for heteroskedasticity, since the procedure might place too much importance on the low ownership executives whose behavior differs from the rest of the sample more because of economic rather than statistical reasons. However, we report both sets of standard errors for all of our regression results and leave to the reader choices of interpretation.

2. Stock option exercises

We next examine the impact of stock option exercises on stock ownership, studying the subsample of 5,795 person-year observations during which executives exercise options to acquire stock. Our null hypothesis is that managers will retain these shares, implying a coefficient estimate of 1. As shown in the second column of Table 2, Panel A, the estimate is instead very close to zero: -0.054, significantly different from the null hypothesis of 1 below the 1% level according to either standard error. This estimate implies that executives retain virtually none of the shares acquired on the exercise of options.

The overwhelming tendency of executives to sell shares acquired when exercising stock options -- behavior that seems to fly in the face of companies' stated purposes for using options for compensation -- is difficult for us to explain through straightforward tax, liquidity or information effects. For example, executives who exercise options may need to sell some stock to finance the exercise price or to meet income tax liabilities that are triggered by the event.

However, since the exercise price is only a portion of the value of the stock acquired, and since taxes are calculated only as some minority fraction of the excess value of the stock above the exercise price, these two effects should never require selling anywhere near 100% of the shares acquired. In addition, executives can sometimes delay their tax liability indefinitely by continuing to hold the stock acquired by exercising options (Scholes and Wolfson, 1992, present a discussion of the complex personal and corporate income tax rules for stock options). Information effects may present a more plausible explanation; it is possible that many executives exercise options in order to liquidate their positions because they believe the company's shares are overvalued. However, it seems unlikely that *all* stock option exercises are triggered by negative managerial expectations, since many exercises also take place due to information-neutral events such as retirements, job changes, and the ordinary expiration of the options. Carpenter and Remmers (1997), in a comprehensive study of managerial option exercises from 1991 to 1995, fail to find any evidence of abnormal company stock performance following exercises. One further possibility is that firms fully expect their managers to sell all of the shares awarded under stock option plans, notwithstanding the rhetoric about managerial ownership of the type cited in Footnote 1 above. If true, this would raise the issue of why companies don't simply pay managers in cash. Corporate liquidity constraints and the possibility of joint tax savings between the manager and firm might explain some of the use of stock options, and firms might also use option plans as an indirect method of expanding their equity bases without the negative signals that would accompany seasoned equity offerings.[2]

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[2] We thank Diane Denis for this conjecture.

3. Restricted stock awards

We investigate restricted stock awards in a regression shown in the third column of Table 2, Panel A. We find that within the subsample of 3,014 person-years in which executives receive restricted stock awards, substantial selling of stock takes place, to a far greater degree than at the time of stock option awards. Since restricted shares count toward an executive's reported total stock ownership in our dataset, the null hypothesis is that stock holdings will rise by 1 for every restricted share awarded. The estimate for this coefficient is far below 1, +0.214, significantly different from 1 at the 1% level but not significantly different from 0. This estimate implies that the typical executive sells shares equal to about 79% of the restricted shares awarded, strongly hedging the award but not completely following the guidance of modern portfolio theory, which would predict close to 100% selling or a coefficient estimate near zero.

4. Robustness tests

Table 2 also contains two types of robustness tests. In the right column of Panel A, we estimate a regression including all three of the explanatory variables studied separately above, fitting the model over the sample of 13,148 executive-years that include any one of the three events of a stock option award, stock option exercise, or restricted stock award. The sign, magnitude, and significance of all coefficients remain similar when all three variables appear in the model simultaneously, though the estimate for restricted stock climbs from +0.214 to +0.405. This behavior of the restricted stock coefficient suggests more strongly that executives hold at least some of the shares awarded through these plans, since the new, larger coefficient is significantly larger than zero though still significantly less than 1. The increase in the

coefficient, which occurs when the sample is expanded to include 10,000 additional executive-year observations in which zero restricted stock is awarded but some stock option activity takes place, suggests that some collinearity exists among option awards, option exercises, and restricted stock awards.

In Panel B of Table 2, we repeat all of the analysis from Panel A using cumulative three-year totals for compensation awards and stock ownership changes. We have two motivations for this estimation. First, the three-year analysis, covering a period of 156 weeks, should greatly reduce any bias in the coefficients that arises due to the discrepancy of approximately ten weeks between the time intervals in which compensation events occur and changes in stock ownership are measured. Second, the analysis is free by construction of any concerns stemming from serial correlation of executives' annual observations. Three-year results in Panel B are quite similar to the analysis based on annual data shown in Panel A, though we find slightly greater retention of shares acquired through stock option exercises and restricted stock, and slightly more selling of shares in response to stock option awards.

B. High and Low Ownership Executives

Our results suggest that executives sell previously acquired shares of stock soon after receiving stock options or restricted stock awards. However, this behavior will be possible only if a manager already owns a sufficient number of shares that do not have restrictions on their sale (this constraint will not apply for stock option exercises, since the same shares acquired from exercising an option can immediately be sold in most cases). We study the importance of an executive's prior holdings of stock by segmenting our sample into "high ownership" and "low

ownership" groups. We define indicator variables for each of these subsamples, using the criterion of whether each executive owns more or fewer than the median percentage of approximately 0.076% of his firm's shares (see Table 1).[3] We then interact these indicator variables with our explanatory variables for the regressions in Table 2, decomposing each variable into two new ones. Results from reestimating the regressions on this basis appear in Table 3.

Considerable evidence in Table 3 suggests that the level of prior executive stock ownership influences managers' responses to new compensation awards. Selling of shares after the receipt of stock option and restricted stock awards appears far more vigorous when managers belong to the high ownership half of the sample and have large inventories of stock that can be sold.

For stock options, estimates in the right column indicate that high ownership managers sell approximately 265 shares of stock for every 1,000 new options awarded. This estimate is significantly lower at the 1% level than the corresponding figure for low ownership managers (at the 4% level using White standard errors), which is surprisingly positive but not statistically significant. We do not have a clear explanation for why the first-column results seem to indicate that low ownership managers increase their stock ownership during the same years in which they receive new stock option awards. One possibility is that they tend to receive restricted stock awards during the same years; this conjecture is consistent with the movement of the coefficient toward zero in the third column after restricted stock awards are included in the regression.

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[3] Our results are insensitive to numerous alternative definitions of high and low ownership based on such measures as the dollar value or number of shares owned.

The dichotomous behavior between low and high ownership executives also extends to the exercise of stock options, as we find low ownership executives retaining about 30% of the options they acquire on exercise while high ownership managers sell approximately all of the shares acquired. The difference between these coefficients, while significant at the 2% level using regular standard errors, is not statistically significant with White standard errors.

For restricted stock, estimates in the third column of Table 3 suggest that low ownership executives engage in very little selling after receiving restricted shares, as the coefficient estimate of +0.93 is quite close to the null hypothesis value of 1. High ownership executives, in contrast, appear to sell shares equal to 86% of the restricted shares awarded; the difference in these coefficients is significant at the 1% level with White standard errors but is not significant using regular standard errors. However, these coefficients move much closer together and lose their significant difference when stock option variables are included in the regression.

In Table 4, we present a model that investigates selling across the ownership spectrum in finer detail. Instead of using two interaction dummy variables for ownership above and below the median, we reestimate our model with four dummies, representing percentage ownership (a) above zero but below the median of 0.076%, (b) from the median to the 75th percentile of 0.33%, (c) from the 75th percentile to 90th percentile of 1.53%, and (d) in the top decile. The left column of Table 4 presents results for the interaction between these variables and the number of new stock options awarded; similar models using the number of options exercised and number of restricted shares awarded appear in the second and third columns, respectively. Results in Table 4 suggest that selling at the time of stock option awards is confined to those managers with the highest ownership, while the tendency to sell shares at the time of option exercises and

restricted share awards increases steadily and monotonically as a function of prior stock ownership.

Managers with very high stock ownership appear to hedge the risks of stock option awards completely. In the first column of Table 4, we see that managers in the top ownership decile are estimated to sell approximately 72% of the number of shares awarded under option, a strikingly large estimate that slightly exceeds the estimated hedge ratio of approximately 0.6. Managers with lower ownership appear to behave quite differently, actually increasing ownership on the order of 7% to 10% during years in which they receive new options. When option exercise and restricted share award variables are also included in the model, the first three stock option award coefficients move toward zero, with magnitudes implying ownership increases in a range of 3% to 6% with borderline statistical significance. As noted above, we do not have a clear explanation for why managers should increase rather than decrease share ownership under these conditions. It is important to remember the highly skewed distribution of managerial share ownership when reading these results; the 90th ownership percentile, while very far along the ownership spectrum on a percentage basis, represents only 1.53% ownership of the firm, implying that managers who own more than a nominal fraction of the firm's equity will generally hedge the risks of option awards quite strongly.

For option exercises, the second column of Table 4 indicates a decreasing tendency of managers to hold the acquired shares as a function of their prior ownership. Managers below the ownership median are estimated to retain 36% of the shares acquired from exercising options, while this retention frequency falls to 22% for managers between the 50th and 75th ownership percentiles, to 10% for managers between the 75th and 90th percentiles, and to a surprisingly

negative -36% in the top ownership decile, implying selling of even more shares than those involved in the option exercise. A very similar pattern appears for restricted stock awards, shown in the third column of Table 4, as we estimate retention frequencies of 98%, 59%, 35%, and -17% across the four ownership ranges studied.

Our piecewise analysis of high and low ownership managers thus indicates important qualifications to our main results. While overall sample statistics suggest that stock-based compensation does not rase the ownership of managers, it does seem to serve this purpose for managers who have low ownership *ex ante*. Under these conditions little if any selling occurs when managers receive options or restricted shares, and managers retain a meaningful fraction of the shares acquired from exercising options.

Conversely, our results suggest an eagerness of managers with very high ownership to liquidate their positions, since their selling upon the receipt of stock-based compensation appears to exceed that necessary to hedge completely the risks associated with the new shares. Rather than indicating straightforward risk-reduction behavior, therefore, our results may instead illuminate a pattern of managerial selling that would arise if certain firms relied heavily on stock-based compensation instead of cash pay. One would expect managers in these firms eventually to liquidate shares for consumption reasons, even as they might be receiving new awards for current-year compensation. Even though such a pattern in the data would not necessarily support an interpretation that managers actively hedge the risks of stock-based compensation, the economic outcome would be much the same.

C. Robustness Tests

We explore whether our results exhibit heterogeneity among certain classes of executives and different firm sizes. Table 5 presents estimates fitted over various subsamples of observations. We use the specification introduced in Table 3 that includes high and low ownership decompositions of the key regressor variables. The first two columns show estimates for CEOs and all other executives, while the right three columns show estimates for firms included in the S&P 500, S&P MidCap 400, and S&P SmallCap 600. Our definitions of indicator variables for high and low ownership executives are recalculated within the appropriate subsample analyzed in each column. While a few coefficient estimates lack significance or diverge from the overall pattern, the results show no systematic differences across the five subsamples. We again observe managers appearing to sell shares after receiving options and restricted stock and retaining few of the shares acquired from the exercise of options, with high ownership executives accounting for much more selling than their low ownership counterparts.

We estimate a variety of alternative models to test the robustness of our results to changes in the functional form of variables and the estimation procedure. Three additional sets of estimates appear in Table 6. The first column of the table presents estimates for our basic model augmented by a series of additional control variables: the executive's prior stock ownership (as a percentage of shares outstanding), the stock price at the start of the year, the stock return during the year, and the firm's equity market value at the start of the year. We see little change in the estimates for the main explanatory variables after including these new controls, except that the estimate of selling by high ownership managers in response to stock option awards changes from -0.265 to -0.146, enough to lose statistical significance with White standard errors. We

experiment with different functional forms in the models shown in the right two columns of Table 6. In the second column, we divide each variable by the number of shares outstanding at the start of the year, so that all variables are expressed on a percentage-of-shares outstanding basis. The final column is a model with all variables expressed in dollar values, obtained by multiplying share totals by the stock price at the start of the year. These transformations have little effect on our estimates. We still find that executives tend to sell shares in patterns that hedge the risks of stock option and restricted stock awards, and that they retain only a fraction of shares acquired from exercising previously awarded options. These estimated effects are all more pronounced for executives who already have high stock ownership.

We estimate quantile regressions with coefficients representing the median amount of selling activity per share of the various forms of stock-based compensation. Again we find that prior stock ownership is extremely important for explaining patterns of managerial selling, so we estimate the quantile regressions over subsamples that correspond to the four ownership ranges described above. We do not report results in a table to conserve space.

For the subsample of executives with percentage ownership below the 50th percentile, our estimate of the median ownership change per option awarded is near zero, +0.9%. This coefficient remains near zero over the ownership ranges between 50% and 75% (where it is estimated as +2.7%) and 75% to 90% (estimated at +0.05%), but becomes negative at -6.5% for managers in the top ownership decile. All of these median regression estimates, while apparently increasing as a function of executives' stock ownership, are well below the magnitude of our OLS estimates of selling in response to option awards. One possibility is that the OLS regressions are driven by very heavy selling by those managers receiving the largest option

awards; further OLS estimates over subsamples of executives receiving large awards (not reported to save space) confirm this conjecture.

We find much greater congruence between our OLS and quantile regression estimates for the other two relationships that we study. When managers exercise options, quantile regression estimates imply median selling activity close to 100% of the shares acquired. The median ownership increases estimated over the four subsamples all indicate close to zero retention: 0.2%, 5.4%, 0.8%, and -0.2%. Quantile regression estimates of restricted stock hedging activity roughly follow the OLS estimates in Table 4: estimated median ownership increases over the four ownership ranges are 95%, 80%, 54%, and 21% of the shares awarded.

D. Stock Option Inventories

Results presented above provide evidence that executives sell stock to counteract major changes in their personal holdings due to option awards, option exercises, and restricted stock awards. We conjecture that further risk-reducing sales take place over time if managers hold inventories of previously granted options. When a firm's stock price rises, option inventory values rise and have greater sensitivity to changes in stock price. The passage of time also increases the sensitivity of the option value to changes in stock price for options with the stock price above the exercise price (we assume the majority of options in our sample fall into this category, since most were issued during the bull market of the late 1980s and early 1990s). All of these effects suggest that managers who hold options should continue to sell additional stock over time for hedging purposes, particularly if the firm's stock price is rising.

Table 7 presents regression models that investigate this hypothesis. We regress the

annual change in executive stock ownership against the option inventory, calculated as option holdings at the start of the year minus the number of options exercised during the year. The model is estimated over the sample of 14,240 executives who have nonzero inventories of both stock and stock options at the start of a given year. We find a negative coefficient estimate as expected, significant at the 1% level according to regular standard errors but not significant with White standard errors. We refine this result by adding an interaction variable between the option inventory and the percentage increase during the year in the company's stock price. Though its inclusion in the model causes the main variable to fall in magnitude and lose its significance, the interaction term has a negative and significant estimate, again with regular standard errors only, indicating that managers sell increasing numbers of shares as options move deeper into-the-money.

Our conclusion from this evidence is that executives may engage in some ongoing hedging of stock option inventories, but the effect appears small and of marginal importance compared to other selling documented in this paper. Further, the results in the right column of Table 7 may also be explained by a tendency of managers to sell shares as company stock prices rise. However, it is not clear that managers should behave this way if future changes in stock prices are not forecastable (e.g., if future stock price changes follow a random walk), though considerations of risk aversion might be important.

IV. Discussion and Conclusions

We study how executives' stock ownership responds to awards of stock options and restricted stock, which are often touted by firms as instruments for increasing managers'

ownership. We find that when managers receive new options, they reduce the risk exposure created by the award by selling shares of stock they already own, in a quantity equal to nearly 20% of the number of options awarded. However, more detailed analysis shows that very heavy selling by managers in the top decile of stock ownership accounts for most of this effect. Awards of restricted stock lead to more dramatic sales of stock, on the order of 60% of the number of shares awarded, with the tendency of managers to hedge these awards rising steadily across the spectrum of ownership. When executives exercise options and acquire shares of stock, nearly all of the shares are sold by the typical manager, a pattern that is also found to increase steadily as managerial ownership rises. Our results imply that managers can and do act to hedge the risks associated with stock-based compensation, counteracting their boards' attempts to tie wealth more closely to firm performance. However, low ownership managers do exhibit ownership increases that appear to be linked as expected to stock-based compensation.

The different responses of low and high ownership executives to stock-based compensation appear to represent some of the more intriguing findings in the paper, since they imply that boards have some success in causing managers to maintain a threshold level of ownership in the firm that they might otherwise wish to avoid. Related future research might investigate such questions as, how frequently do boards of directors establish and enforce policies that require managers to make minimum investments in their firms' equity? How high are these targets, and do they increase with a manager's service or position in the firm? What consequences, if any, are faced by managers who do not adhere to boards' stock ownership targets, or by companies whose boards do not establish such targets? When is substantial selling by managers tacitly permitted by the board?

References

Black, Fischer and Myron Scholes, 1973, The pricing of options and corporate liabilities, Journal of Political Economy 81, 637-659.

Bolster, Paul, Don Chance, and Don Rich, 1996, Executive equity swaps and corporate insider holdings, Financial Management 25:2, 14-24.

Bowen, Sarah, 1996, Enough! Shareholders like the idea of using stock as a pay incentive, but now, some say, it has gone too far. The Wall Street Journal, April 11, R6.

Carpenter, Jennifer N., and Barbara Remmers, 1997, Stock price performance following insider option exercise, Unpublished manuscript, Stern School of Business, New York University.

Ip, Greg, 1997, Collars give insiders way to cut risk. The Wall Street Journal, September 17, C1.

Jensen, Michael C. and William H. Meckling, 1976, Theory of the firm: managerial behavior, agency costs and ownership structure, Journal of Financial Economics 3, 305-360.

Holmström, Bengt, 1979, Moral hazard and observability, Bell Journal of Economics 10, 74-91.

Jensen, Michael C., and Kevin J. Murphy, 1990, CEO incentives -- It's not how much you pay, but how, Harvard Business Review 90:3, 138-151.

O'Brian, Bridget, 1997, Help abounds for cash-poor yet stock-rich, The Wall Street Journal, April 30, C1.

Scholes, Myron and Mark A. Wolfson, 1992, *Taxes and business strategy: A planning approach* (Prentice Hall, Englewood Cliffs, NJ).

White, Halbert, 1980, A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity, Econometrica 48, 817-838.

Table 1

Descriptive statistics about executive compensation for a panel of 8,516 executives in 1,646 firms between 1993 and 1995. The sample includes a total of 18,558 person-year observations and is drawn from Standard and Poor's ExecuComp database. The subsample in panel B includes the 13,148 executives with non-zero stock ownership at the start of the year and positive option or restricted stock awards or option exercises during the year.

Panel A lists the fraction of person-year observations during which executives received new stock option awards, exercised previously awarded options, and received restricted stock awards. Panel B presents descriptive statistics about those awards on an annual basis, as well as cumulative three-year totals for those executives who appear every year of the sample. Panel C presents a comparison for CEOs and all other executives.

A. SAMPLE FREQUENCIES

	Percent of all executives with
Observations	18,558
New options awarded	67.9%
Options exercised	34.4
Restricted shares awarded	17.2

B. DESCRIPTIVE STATISTICS

	Number of shares (thousands)			$\frac{number\ of\ shares}{shares\ outstanding}$		
Variable	Mean	Median	STD	Mean	Median	STD
Shares owned	428.07	41.70	3194.03	0.830%	0.076%	3.018%
Annual changes obs=13,148						
Change in shares owned	-12.55	0.81	483.68	-0.019	0.001	0.679
New options awarded	58.81	23.00	144.61	0.130	0.045	0.334
Options exercised	24.13	0.00	109.85	0.048	0.000	0.183
Restricted shares awarded	3.84	0.00	22.65	0.007	0.000	0.077
Salary+bonus (thousands $)	605	430	825			
Three-year changes obs=3,222						
Change in shares owned	-5.24	5.19	889.28	0.031	0.009	1.547
New options awarded	171.10	75.00	320.72	0.337	0.154	0.637
Options exercised	68.36	10.99	254.84	0.126	0.018	0.355
Restricted shares awarded	11.00	0.00	44.10	0.021	0.000	0.158

Table 1 continued

C. CEOs vs other executives

Variable (000)	Non-CEO Mean	Non-CEO Median	Non-CEO STD	CEO Mean	CEO Median	CEO STD
	Non-CEO			CEO		
Shares owned	184.23	29.05	1166.36	1179.59	159.59	6059.00
Change in shares owned	-6.05	0.68	210.21	-32.59	1.48	904.68
New options awarded	41.01	19.53	94.13	113.66	50.00	232.56
Options exercised	18.56	0.00	62.59	41.32	0.00	191.84
Restricted shares awarded	2.82	0.00	15.54	7.00	0.00	36.56
Salary+bonus	486	367	456	958	704	1380

Table 2

Ordinary least squares regressions of changes in executive stock ownership as a function of stock-based compensation awards. The sample includes 13,148 person-year observations between 1993 and 1995 for executives who either exercised options or received options or restricted stock, and also had non-zero stock holdings at the beginning of the year. The dependent variable is the increase in the number of shares held by the executive. Independent variables are the number of stock options awarded, the number of shares acquired from the exercise of previously awarded options, and the number of shares of restricted stock awarded. Each regression is estimated over the subsample of executives with non-zero values of the relevant independent variable. The first column of the table indicates the null hypothesis for each regression coefficient. Two measures of the standard error appear below each estimate in parentheses; the first is the regular standard error and the second is the White (1980) standard error robust to heteroskedasticity.
Panel A presents results with each variable measured on an annual basis. Panel B repeats the analysis with variables measured in three-year totals, for those executives appearing in every year of the sample.

Panel A

CHANGE IN SHARES OWNED AND STOCK-BASED COMPENSATION – ANNUAL

Dependent variable		Annual change in the number of shares			
Intercept (000)		-1.662	-4.146	-6.223	-3.427
		(5.119)	(5.520)	(8.762)	(4.604)
		(5.500)	(4.072)	(9.006)	(4.375)
Annual number of new options awarded	$H0$=0	-0.180			-0.192
		(0.030)^a			(0.030)^a
		(0.108)^c			(0.115)^c
Annual number of options exercised	$H0$=1		-0.054		0.025
			(0.033) ^{d}		(0.040) ^{d}
			(0.108) ^{d}		(0.121) ^{d}
Annual number of restricted shares	$H0$=1			0.214	0.405
				(0.183) ^{d}	(0.187)^{bd}
				(0.134) ^{d}	(0.156)^{ad}
Observations		11,321	5,795	3,014	13,148
Adjusted R-sq		0.0030	0.0002	0.0001	0.0033

a,b,c denotes significantly different from 0 at the 1%, 5%, and 10% levels.
d,e,f denotes significantly different from 1 at the 1%, 5%, and 10% levels, if $H0$=1.

Table 2
Panel B
CHANGE IN SHARES OWNED AND STOCK-BASED COMPENSATION – 3 YEARS

Dependent variable		Three year change in the number of shares			
Intercept (000)		4.960	-1.044	22.184	8.226
		(17.169)	(17.195)	(17.091)	(18.531)
		(20.331)	(21.087)	(12.270)^{c}	(19.297)
Number of new options awarded, 3-year total	$H0$=0	-0.197			-0.297
		(0.045)^{a}			(0.060)^{a}
		(0.135)			(0.156)^{c}
Number of options exercised, 3-year total	$H0$=1		-0.048		0.163
			(0.050) ^{d}		(0.073)^{bd}
			(0.148) ^{d}		(0.179) ^{d}
Number of restricted shares, 3-year total	$H0$=1			0.103	0.693
				(0.211) ^{d}	(0.364)^{c}
				(0.302) ^{d}	(0.387)^{c}
Observations		2,771	1,905	983	2,969
Adjusted R-sq		0.0141	0.0018	0.0023	0.0087

a,b,c denotes significantly different from 0 at the 1%, 5%, and 10% levels.
d,e,f denotes significantly different from 1 at the 1%, 5%, and 10% levels, if $H0$=1.

Table 3

SMALL RELATIVE TO LARGE STOCK OWNERSHIP

Ordinary least squares regressions of changes in executive stock ownership as a function of stock-based compensation awards. The sample includes 13,148 person-year observations between 1993 and 1995 of executives who either exercised options or received options or restricted stock, and also had non-zero stock holdings at the beginning of the year. The models and analysis are identical to those presented in Table 2, except that independent variables are interacted with indicators for whether the executive has high or low stock ownership. High and low stock ownership executives are divided according to the sample median percentage of shares owned. Two measures of the standard error appear below each estimate in parentheses; the first is the regular standard error and the second is the White (1980) standard error robust to heteroskedasticity.

Dependent variable		Annual change in the number of shares			
Intercept (000)		-6.300	-10.011	-9.312	-8.974
		(5.191)	(5.674)^{c}	(9.012)	(4.691)^{c}
		(4.589)	(5.339)^{c}	(9.625)	(3.999)^{b}
Options awarded to low ownership executives	$H0$=0	0.093			0.044
		(0.059)			(0.060)
		(0.024)^{a}			(0.036)
Options awarded to high ownership executives	$H0$=0	-0.258			-0.265
		(0.034)^{a}			(0.034)^{a}
		(0.137)^{c}			(0.148)^{c}
Options exercised by low ownership executives	$H0$=1		0.331		0.290
			(0.092)^{ad}		(0.111)^{ad}
			(0.234) ^{d}		(0.236) ^{d}
Options exercised by high ownership executives	$H0$=1		-0.096		0.011
			(0.034)^{ad}		(0.042) ^{d}
			(0.122) ^{d}		(0.142) ^{d}
Restricted shares awarded to low ownership executives	$H0$=1			0.930	0.686
				(0.523)^{c}	(0.548)
				(0.270)^{a}	(0.155)^{ae}
Restricted shares awarded to high ownership executives	$H0$=1			0.141	0.386
				(0.189) ^{d}	(0.198)^{cd}
				(0.151) ^{d}	(0.178)^{bd}
Observations		11,308	5,787	3,014	13,148
Adjusted R-sq		0.0056	0.0039	0.0012	0.0061

a,b,c denotes significantly different from 0 at the 1%, 5%, and 10% levels.
d,e,f denotes significantly different from 1 at the 1%, 5%, and 10% levels, if $H0$=1.

Table 4

RANGES OF STOCK OWNERSHIP

Ordinary least squares regressions of changes in executive stock ownership as a function of stock-based compensation awards. The sample includes 13,148 person-year observations between 1993 and 1995 of executives who either exercised options or received options or restricted stock, and also had non-zero stock holdings at the beginning of the year. The dependent variable for each model is the increase in number of shares held by executive. Each model uses a different explanatory variable, X1, which is listed at the head of the column. This variable is interacted with dummy variables that indicate different ranges of executive stock ownership. Two measures of the standard error appear below each estimate in parentheses; the first is the regular standard error and the second is the White (1980) standard error robust to heteroskedasticity.

Dependent variable	Annual change in the number of shares		
X_1=	Options awarded	Options exercised	Restricted shares
	$H0$=0	$H0$=1	$H0$=1
Intercept (000)	-10.092	-14.404	-11.769
	(5.183)^{c}	(5.730)^{b}	(9.121)
	(3.848)^{a}	(6.242)^{b}	(10.080)
$X_1\times$ ownership below median dummy	0.108	0.355	0.979
	(0.059)^{c}	(0.092)^{ad}	(0.524)^{c}
	(0.022)^{a}	(0.236) ^{d}	(0.284)^{a}
$X_1\times$ ownership between 50-75 percetile dummy	0.105	0.217	0.585
	(0.066)	(0.090)^{bd}	(0.394)
	(0.022)^{a}	(0.056)^{ad}	(0.285)^{b}
$X_1\times$ ownership between 75-90 percetile dummy	0.071	0.097	0.346
	(0.055)	(0.051)^{cd}	(0.338) ^{f}
	(0.041)^{c}	(0.053)^{cd}	(0.200)^{cd}
$X_1\times$ ownership in upper decile dummy	-0.722	-0.360	-0.177
	(0.050)^{a}	(0.049)^{ad}	(0.267) ^{d}
	(0.300)^{b}	(0.381) ^{d}	(0.581) ^{e}
Observations	11,308	5,787	3,014
Adjusted R-sq	0.0191	0.0134	0.0022

a,b,c denotes significantly different from 0 at the 1%, 5%, and 10% levels.
d,e,f denotes significantly different from 1 at the 1%, 5%, and 10% levels, if $H0$=1.

Table 5
VARIOUS SUBSAMPLES

Ordinary least squares regressions of changes in executive stock ownership as a function of stock-based compensation awards. The sample includes 13,148 person-year observations between 1993 and 1995 for executives who either exercised options or received options or restricted stock, and also had non-zero stock holdings at the beginning of the year. The regression model is identical to that in Table 3. This table presents regression estimates over five subsamples. The left two columns present estimates for CEOs compared to all other executives. The right three columns present estimates for executives from large, mid-sized, and small firms as defined by Standard & Poor's. Two measures of the standard error appear below each estimate in parentheses; the first is the regular standard error and the second is the White (1980) standard error robust to heteroskedasticity.

Subsample		Non-CEOs	CEOs	S&P 500	Mid-cap	Low-cap
Dependent variable		Annual change in the number of shares				
Intercept (000)		-2.680	-32.131	-11.884	-7.176	-6.652
		(2.386)	(18.346)^{c}	(9.384)	(9.143)	(3.022)^{b}
		(2.814)	(14.130)^{b}	(8.365)	(7.246)	(3.389)^{b}
Options awarded to low ownership executives	$H0$=0	0.045	0.093	0.100	-0.079	0.133
		(0.042)	(0.122)	(0.121)	(0.123)	(0.061)^{b}
		(0.019)^{b}	(0.055)^{c}	(0.038)^{a}	(0.104)	(0.106)
Options awarded to high ownership executives	$H0$=0	-0.273	-0.298	-0.049	-0.347	-0.258
		(0.026)^{a}	(0.084)^{a}	(0.054)	(0.066)^{a}	(0.029)^{a}
		(0.121)^{b}	(0.241)	(0.124)	(0.285)	(0.122)^{b}
Options exercised by low ownership executives	$H0$=1	0.046	0.579	0.050	1.157	0.223
		(0.070) ^{d}	(0.261)^{b}	(0.223) ^{d}	(0.215)^{a}	(0.137) ^{d}
		(0.025)^{cd}	(0.364)	(0.038) ^{d}	(0.905)	(0.101)^{bd}
Options exercised by high ownership executives	$H0$=1	0.005	0.013	-0.035	-0.326	0.209
		(0.038) ^{d}	(0.093) ^{d}	(0.061) ^{d}	(0.091)^{ad}	(0.052)^{ad}
		(0.067) ^{d}	(0.201) ^{d}	(0.163) ^{d}	(0.162)^{bd}	(0.120)^{cd}
Restricted shares awarded to low ownership executives	$H0$=1	0.863	0.834	0.974	0.362	0.579
		(0.381)^{b}	(1.036)	(1.069)	(1.995)	(0.675)
		(0.105)^{a}	(0.221)^{a}	(0.128)^{a}	(0.499)	(0.204)^{ae}
Restricted shares awarded to high ownership executives	$H0$=1	0.249	0.484	0.390	0.195	0.445
		(0.145)^{cd}	(0.480)	(0.502)	(0.348) ^{e}	(0.107)^{ad}
		(0.196) ^{d}	(0.303) ^{f}	(0.541)	(0.281) ^{d}	(0.166)^{ad}
Observations		9,927	3,321	4,933	3,263	3,953
Adjusted R-sq		0.0127	0.0074	0.0009	0.0235	0.0280

a,b,c denotes significantly different from 0 at the 1%, 5%, and 10% levels.
d,e,f denotes significantly different from 1 at the 1%, 5%, and 10% levels, if $H0$=1.

Table 6
ROBUSTNESS TESTS

Regressions of changes in executive stock ownership as a function of stock-based compensation awards. The sample includes 13,148 person-year observations between 1993 and 1995 for executives who either exercised options or received options or restricted stock, and also had non-zero stock holdings at the beginning of the year. The first column presents a model with additional control variables included for the executive's stock ownership (percent of outstanding shares), the company's stock price at the start of the year, the return to stockholders during the year, and the market value of equity (natural log) at the start of the year. The final two columns present models using alternative specifications of both the dependent and explanatory variables. In the second column, all variables are defined as a fraction of shares outstanding. In the third column, all variables are defined in dollar values formed by multiplying the start-of-year stock price by the number of shares. The models have specifications similar to Table 3, in which the compensation variables are decomposed according to whether executives have high or low stock ownership. High and low stock ownership executives are divided according to the sample median percentage of shares owned. Two measures of the standard error appear below each estimate in parentheses; the first is the regular standard error and the second is the White (1980) standard error robust to heteroskedasticity.

Dependent variable:		# of shares owned	$\Delta \frac{\#shares}{Shs\ out}$	Δ Dollars
Intercept		125.919	-0.023	-242.901
		(23.149)[a]	(0.007)[a]	(103.433)[b]
		(42.432)[a]	(0.007)[a]	(98.537)[b]
Options awarded to low ownership executives	$H0$=0	0.044	0.048	0.045
		(0.060)	(0.054)	(0.039)
		(0.036)	(0.056)	(0.046)
Options awarded to high ownership executives	$H0$=1	-0.146	-0.138	-0.230
		(0.034)[a]	(0.019)[a]	(0.031)[a]
		(0.135)	(0.047)[a]	(0.149)
Options exercised by low ownership executives	$H0$=1	0.296	0.476	0.269
		(0.111)[ad]	(0.107)[ad]	(0.079)[ad]
		(0.241)[d]	(0.300)[f]	(0.219)[d]
Options exercised by high ownership executives	$H0$=0	0.011	0.183	0.137
		(0.042)[d]	(0.034)[ad]	(0.033)[ad]
		(0.134)[d]	(0.120)[d]	(0.111)[d]
Restricted shares awarded to low ownership executives	$H0$=1	0.692	0.366	0.909
		(0.539)	(0.317)[e]	(0.425)[b]
		(0.192)[a]	(0.290)[e]	(0.183)[a]
Restricted shares awarded to high ownership executives	$H0$=1	0.425	0.329	0.648
		(0.195)[bd]	(0.079)[ad]	(0.244)[a]
		(0.178)[bd]	(0.059)[ad]	(0.341)[c]

Table 6 continued

Dependent variable:	# of shares owned	$\Delta \frac{\#shares}{Shs\ out}$	Δ Dollars
Percent owned	-27.586		
	(1.406) [a]		
	(7.563) [a]		
Stock price at the beginning of the year, P_0	1.143		
	(0.326)[a]		
	(0.388) [a]		
Stock return during the year	-4.697		
	(9.695)		
	(9.548)		
Log of market value of equity at the beginning of the year	-20.820		
	(3.918)[a]		
	(6.871)[a]		
Observations	13,113	13,148	13,148
Adjusted R-sq	0.035	0.0086	0.0065

a,b,c denotes significantly different from 0 at the 1%, 5%, and 10% levels.
d,e,f denotes significantly different from 1 at the 1%, 5%, and 10% levels, if $H0$=1.

Table 7

ACTIVE HEDGING OF THE OPTIONS INVENTORY

Ordinary least squares regressions of changes in executive stock ownership as a function of inventories of previously awarded stock options. The total sample includes 14,240 person-year observations between 1993 and 1995 for executives with non-zero holdings of both options and stock at the beginning of the year. The dependent variable is the increase in the number of shares held by the executive. The main independent variable is the number of previously awarded stock options held at the start of the year, minus options exercised during the year (if any). In the right column, the model is augmented by an interaction term between the option inventory variable and the percentage rise in the company's stock price during the year. Two measures of the standard error appear below each estimate in parentheses; the first is the regular standard error and the second is the White (1980) standard error robust to heteroskedasticity.

Dependent variable	Annual change in the number of shares	
Intercept (000)	-0.138	-1.241
	(4.323)	(4.356)
	(6.096)	(5.437)
Total options inventory	-0.031	-0.015
	(0.009)[a]	(0.010)
	(0.034)	(0.029)
Total options inventory ×		-0.046
% change in stock price		(0.015)[a]
		(0.049)
Observations	14,240	14,179
Adjusted R-sq	0.0008	0.0015

a,b,c denotes significantly different from 0 at the 1%, 5%, and 10% levels.